COVER SHEET
Public Review Draft – May 2003

Title of Environmental Review:	Environmental Assessment of a National Oceanic and Atmospheric Administration (NOAA) Determination That the 10 Hatchery and Genetic Management Plans (HGMPs) submitted by the United States Fish and Wildlife Service (USFWS) Address Section 4(d) Limit Criteria and Do Not Appreciably Reduce the Likelihood of Survival and Recovery of Salmon and Steelhead Listed Under the Endangered Species Act
Evolutionarily Significant Units Affected:	Lower Columbia River Steelhead, Middle Columbia River Steelhead, Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, and Upper Willamette River Spring Chinook Salmon
Responsible Agency and Official:	D. Robert Lohn NOAA – National Marine Fisheries Service 7600 Sand Point Way N.E. Seattle, WA 98115
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Legal Mandate:	Endangered Species Act of 1973, as amended and implemented 50 CFR Part 223
Location of Proposed Activities:	Lower and Middle Columbia River Basin in the States of Washington and Oregon
Action Considered:	Approval of 10 HGMPs submitted by the USFWS for approval under limit 5 of the 4(d) rule. The submitted HGMPs are as follows: 1) Little White Salmon/Willard National Fish Hatchery Complex coho salmon

2) Little White Salmon/Willard National Fish Hatchery Complex spring chinook salmon
3) Little White Salmon/Willard National Fish Hatchery Complex fall chinook salmon
4) Carson National Fish Hatchery spring chinook salmon
5) Spring Creek National Fish Hatchery tule fall chinook salmon
6) Eagle Creek National Fish Hatchery coho salmon
7) Eagle Creek National Fish Hatchery winter steelhead
8) Warm Springs National Fish Hatchery spring chinook salmon
9) Touchet River summer steelhead
10) Walla Walla River summer steelhead

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1.0 Purpose Of and Need For the Proposed Action

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) issued a final Endangered Species Act (ESA) rule pursuant to section 4(d) (4(d) Rule), adopting regulations necessary and advisable to conserve threatened species (July 10, 2000, 65 FR 42422). This 4(d) Rule applies the take prohibitions in section 9(a)(1) of the ESA, and also sets forth specific circumstances when the prohibitions will not apply, known as 4(d) limits. Limit 5 under the 4(d) Rule (50 CFR 223.203(4)) limits the application of the take prohibitions if a hatchery management agency develops and implements a Hatchery Genetic and Management Plan (HGMP) that NMFS approves under Limit 5.

1.2 Description of Action

The United States Fish and Wildlife Service (USFWS) has submitted HGMPs for approval under Limit 5 for artificial propagation programs in the Columbia River chum salmon, Lower Columbia River steelhead, Lower Columbia River chinook salmon, Upper Willamette River spring chinook salmon, and Middle Columbia River steelhead Evolutionarily Significant Units (ESUs). The USFWS submitted 10 HGMPs for artificial propagation at:

- Little White Salmon/Willard National Fish Hatchery complex (USFWS 2002a; USFWS 2002b; USFWS 2002c),
- Carson National Fish Hatchery (USFWS 2002d),
- Spring Creek National Fish Hatchery (USFWS 2002e),
- Eagle Creek National Fish Hatchery (USFWS 2002f; USFWS 2002g), and
- Warm Springs National Fish Hatchery (USFWS 2002h).

These artificial propagation programs produce spring chinook salmon, fall chinook salmon, steelhead, and coho salmon (Table 1). In addition, the USFWS submitted two HGMPs for programs operated by the Washington Department of Fish and Wildlife (WDFW) that release steelhead from the Lyons Ferry Hatchery into the Touchet and Walla Walla Rivers (WDFW 2002a; WDFW 2002b). All of these hatchery programs involve collecting adult salmon and steelhead for broodstock, spawning adults in a hatchery environment, rearing and releasing juveniles, conducting propagation-specific scientific research and monitoring activities, and managing the returning adult fish. All of the programs are designed for harvest augmentation. However, the Touchet River steelhead and the Warm Springs River spring chinook salmon programs are also designed to conserve native, naturally produced salmon and steelhead. Only the Touchet River summer steelhead hatchery program uses ESA-listed fish as broodstock.

Table 1. HGMPs submitted by the U.S. Fish and Wildlife Service.

Hatchery and Genetics Management Plan	Release Number	Release Date	Release Location
Little White Salmon/Willard National Fish Hatchery Complex Coho Salmon	1,000,000 yearlings	mid-April	Little White Salmon River
Little White Salmon/Willard National Fish Hatchery Complex Spring Chinook Salmon	1,000,000 yearlings	mid-April	Little White Salmon River
Little White Salmon/Willard National Fish Hatchery Complex Upriver Bright Fall Chinook Salmon	2,000,000 fingerlings	mid-June	Little White Salmon River
Carson National Fish Hatchery Spring Chinook Salmon	1,420,000 yearlings	3rd week of April	Wind River
Spring Creek National Fish Hatchery Tule Fall Chinook Salmon	3,000,000 unfed fry	January	Columbia River
	15,100,000 fingerlings	March, April, and May	Columbia River
Eagle Creek National Fish Hatchery Coho Salmon	500,000 yearlings	March-May	Eagle Creek
Eagle Creek National Fish Hatchery Winter Steelhead	150,000 yearlings	April-May	Eagle Creek
Warm Springs National Fish Hatchery Warm Springs River Spring Chinook Salmon	75,000 fingerlings	Mid-October to Mid-November	Warm Springs River
	750,000 yearlings	March-April	Warm Springs River
Touchet River Endemic Summer Steelhead†	25,000 fingerlings	1 October	Touchet River
	175,000 yearlings	April	Touchet River
Walla Walla River Summer Steelhead - Lyons Ferry Hatchery Stock	100,000 yearlings	15 April to 25 April	Walla Walla River
Total Releases	25,195,000		

†These release numbers would be reduced in the future. Currently, some of these steelhead are Lyons Ferry stock, but eventually these would be replaced with endemic stock.

The proposed action is to approve the 10 HGMPs. All of these HGMPs address the impacts of the artificial propagation on listed ESUs. NMFS can approve the HGMPs if the plans adequately address the criteria in Limit 5, including the requirement that implementation of the artificial propagation programs described in the HGMPs would not appreciably reduce the likelihood of survival and recovery of ESA-listed salmon and steelhead. NMFS' action of approving these HGMPs would allow the USFWS to conduct certain hatchery programs in compliance with the ESA. NMFS' approval of the HGMPs is the federal action that requires review under the National Environmental Policy Act (NEPA).

This EA evaluates the potential environmental effects of the USFWS's artificial propagation programs if approved by NMFS under Limit 5. Two alternatives are considered in this EA: (1) NMFS does not approve the USFWS HGMPs under Limit 5, and (2) NMFS approves the HGMPs under Limit 5 to allow the USFWS to conduct the artificial propagation programs specified in the HGMPs. No other alternatives were found that were reasonable and/or appreciably different from these two alternatives (Section 2.0, Alternatives Including the Proposed Action).

1.3 Purpose of and Need for Action

The purpose of the proposed action is to implement 10 artificial propagation plans for steelhead, chinook salmon, and coho salmon that comply with the requirements of the ESA, and specifically with Limit 5 of the 4(d) rule. The HGMPs submitted include hatchery guidelines designed to conserve listed steelhead and salmon present in the Lower Columbia River, Upper Willamette River, and Middle Columbia River ESUs. The HGMPs would also include monitoring guidelines to assess the success of the programs and to ensure that programs do not prevent the survival and recovery of ESA-listed salmon and steelhead.

The need for the proposed action is to conserve and enhance natural populations while meeting mitigation responsibilities. Several agreements are currently in place to mitigate for the Columbia River hydroelectric system. These include the Lower Snake River Compensation Plan and the Mitchell Act. The Lower Snake River Compensation Plan is authorized by Congress and mitigates for losses due to the construction and continued operation of the four lower Snake River hydroelectric projects. Through the Lower Snake River Compensation Plan, the USFWS is responsible for funding hatchery programs to mitigate for lost fishing opportunities in the Snake River basin. Two of the artificial propagation programs submitted by the USFWS (for Touchet River and Walla Walla River steelhead) are part of the Lower Snake River Compensation Plan. The Mitchell Act was also enacted by Congress and requires the establishment, operation, and maintenance of one or more salmon hatcheries in each of the states of Oregon, Washington, and Idaho. The Little White Salmon National Fish Hatchery, Carson National Fish Hatchery, Spring Creek National Fish Hatchery, and Eagle Creek National Fish Hatchery artificial propagation programs are funded through the Mitchell Act.

In addition, NMFS and other Federal agencies have a legal obligation to support Columbia River Tribes in efforts to preserve and rebuild Treaty salmon fisheries in the Tribes' usual and accustomed fishing area. The concept of "trust responsibility" is derived from the special relationship between the Federal Government and Tribes, first delineated by Supreme Court Chief Justice John Marshall in *Cherokee Nation* v. *Georgia*, 30 U.S. 1 (5 Pet.) (1831). Later, in *Seminole Nation* v. *United States*, 316 U.S. 286 (1942), the Court noted that the United States "has charged itself with moral obligations of the highest responsibility and trust" toward Indian Tribes. The scope of the Federal trust relationship is broad and incumbent upon all Federal agencies. The U.S. Government has an obligation to protect Tribal land, assets, and resources, as well as a duty to carry out the mandates of Federal law with respect to American Indian and Alaska Native Tribes. This unique relationship provides the Constitutional basis for legislation, Treaties, and Executive Orders that grant unique rights or privileges to Native Americans to protect their property and their way of life. The USFWS operates the Warm Springs National Fish Hatchery to support this concept.

Limit 5 of the 4(d) rule is designed to foster cooperative efforts between fishery managers, such as the states and Tribes, and NMFS when developing artificial propagation programs. Recreational and commercial fishing are important socially and economically in the states of Oregon and Washington; this has been recognized by NMFS in its mission statement, its policies (e.g., the Policy for Conserving Species Listed or Proposed for Listing Under the Endangered Species Act While Providing and Enhancing Recreational Fisheries Opportunities, jointly issued by the Fish and Wildlife Service and the National Marine Fisheries Service on June 3, 1996 (61 FR 27978)), and now through the 4(d) rule.

1.4 Action Area

The action area is the portion of the Columbia River basin that is within the boundaries of the Columbia River chum salmon, Lower Columbia River chinook salmon, Lower Columbia River steelhead, Upper Willamette River spring chinnok salmon, and Middle Columbia River steelhead ESUs. This area includes the mainstem Columbia River and its tributaries from the mouth upstream to the Yakima River (inclusive). The Cowlitz, Kalama, Lewis, Elochoman, Klickitat, White Salmon, Little White Salmon, and Yakima Rivers are the major river systems on the Washington state side, while the Hood, Willamette, Sandy, Deschutes, John Day, Umatilla, and Walla Walla Rivers are foremost on the Oregon side. All 10 of the proposed artificial propagation programs occur within these boundaries (Figure 1).

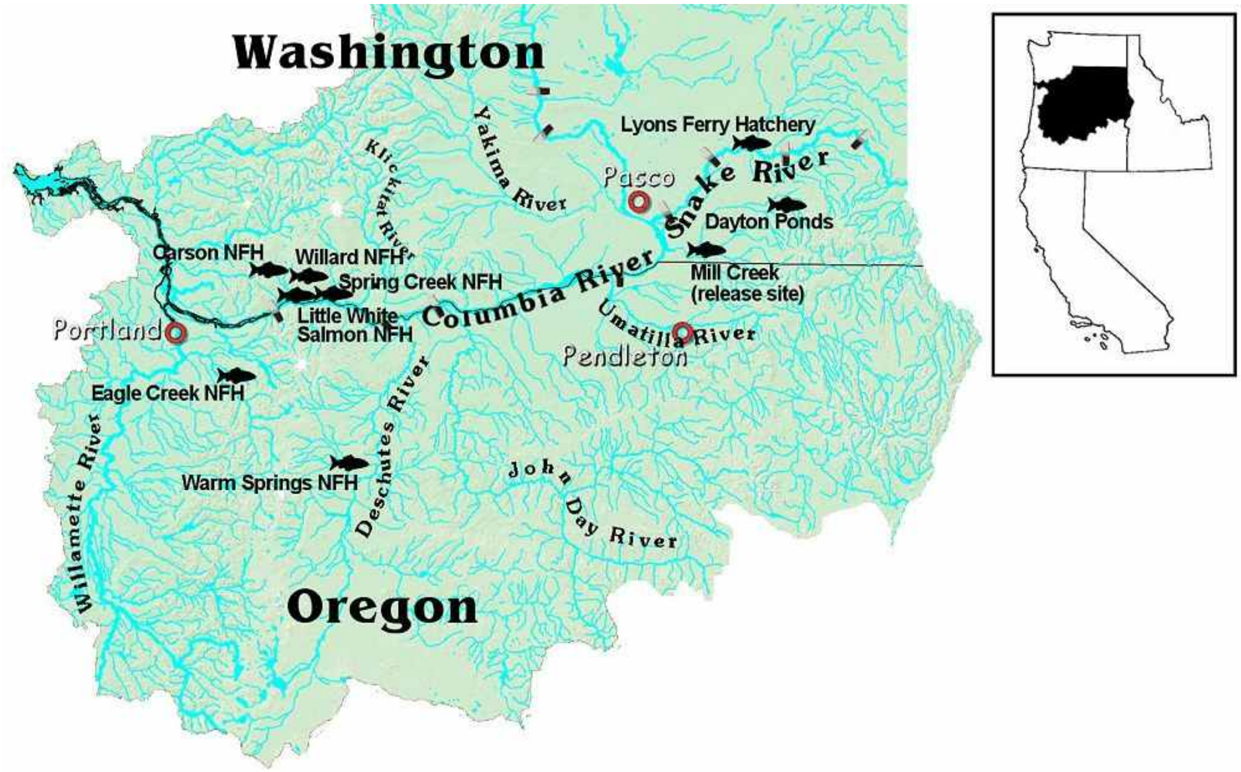

Figure 1. Map of the action area.

1.5 Scoping

The HGMPs developed by the USFWS describe artificial propagation programs and assess the potential impacts to listed salmon and steelhead in the Lower Columbia River, Upper Willamette River, and Middle Columbia River ESUs. The HGMPs include artificial propagation of coho salmon, chinook salmon, and steelhead. Detailed descriptions of the hatchery programs are found in the HGMPs (USFWS 2002a-h; WDFW 2002a; WDFW 2002b). A detailed analysis of the program's effects on listed salmon and steelhead populations will be found in NMFS' pending Evaluation and Recommended Determination document for this proposed action.

1.6 Relationship to Other Plans and Policies

The Proposed Action analyzed in this EA relates to other plans and policies. The Lower Snake River Compensation Plan, the Mitchell Act, and treaty trust responsibilities are discussed in subsection 1.3, Purpose of and Need for Action. In addition, the Proposed Action is consistent with ESA recovery planning.

Recovery plans are being developed in most subbasins in the Columbia River system. These recovery plans will contain (1) measurable goals for delisting, (2) a comprehensive list of the actions necessary to achieve delisting goals, and (3) an estimate of the cost and time required to carry out those actions. All factors that have been identified as leading to the decline of ESA-listed species will be addressed in these recovery plans. For ESA-listed salmon and steelhead, these factors include hydro-electric operations, harvest, habitat use, and artificial propagation. The HGMP establishes reform actions for artificial propagation, and these reform measures would be incorporated in the recovery plans.

In addition, the Proposed Action is consistent with the Basinwide Salmon Recovery Strategy, which was developed by the Federal government to restore ESA-listed salmon and steelhead throughout the Columbia River basin. The strategy outlines specific actions to be taken by the Federal government and proposes additional actions for tribal, state, and local governments. These actions include improving hatcheries, limiting salmon harvest, and restoring salmon habitat. For more details on the use of hatcheries in recovery strategies, please see the Basin Wide Salmon Recovery Plan (Federal Caucus 2000).

2.0 Alternatives Including the Proposed Action

Two alternatives were identified and considered in this EA: under Alternative 1 (No Action), the HGMPs would not be approved as qualifying for limitations on take prohibitions as provided in the ESA 4(d) Rule Limit 5; under Alternative 2, the HGMPs would be approved, and actions implemented pursuant to the HGMPs would qualify for limitations on take prohibitions as provided in the ESA 4(d) Rule Limit 5. Three other general alternatives were considered but consequently eliminated from the detailed analysis because they did not meet the purpose and need for the action or were outside the scope of this EA (see subsection 2.3, Additional Options Considered but not Analyzed in Detail).

2.1 Alternative 1 (No Action)

Under a No Action alternative, NMFS would not approve the HGMPs as qualifying for limitation on take prohibitions under the 4(d) Rule, with the result that artificial propagation programs described in the HGMPs would be subject to section 9 take prohibitions. These hatchery programs have been in operation for many years. Potentially, under the No Action alternative, the USFWS could terminate the 10 hatchery programs and their associated research, monitoring, and evaluation actions to avoid violating the ESA. As a result, it is assumed that the 10 USFWS artificial propagation programs would be eliminated and, consequently, the total number of hatchery fish in the Columbia River basin would be reduced from current levels.

Other mechanisms for the USFWS to achieve compliance with the ESA would exist. However, it is not certain that the USFWS would achieve compliance with the ESA through other regulatory mechanisms. In addition, by defining the No Action alternative as termination of the hatchery programs, NMFS analyzed one end of the impacts spectrum, which then was compared to the Proposed Action.

2.2 Alternative 2 (Proposed Action)

The proposed action is to approve the HGMPs subject to their compliance with reporting requirements. Reporting requirements relevant to the HGMPs would be included in NMFS' 4(d) Rule concurrence letter to the USFWS. This would require that NMFS determine that the HGMPs adequately address the criteria described in section (b)(4)(i) of that rule. These criteria ensure that the proposed artificial programs would not appreciably reduce the survival and recovery of the Columbia River chum salmon, Lower Columbia River chinook salmon, Lower Columbia River steelhead, Upper Willamette River spring chinook salmon, and Middle Columbia River steelhead ESUs.

Details of the programs' operations are available in the 10 HGMPs. The purpose of eight out of the 10 hatchery programs is to provide fish for harvest. The only exceptions are the Touchet River steelhead and the Warm Springs spring chinook salmon programs, which have the dual purpose of providing fish for harvest as well as conserving salmon and steelhead. In general, hatchery staff would collect broodstock from the adult salmon and steelhead that return to the hatchery. However, naturally-produced steelhead in the Touchet River would be taken with a trap, and transported to the Lyons Ferry Fish Hatchery for spawning. None of the adult fish that would be taken in the proposed USFWS hatchery programs are listed under the ESA, with the exception of Touchet River steelhead, which are listed as threatened. The USFWS proposes to trap ESA-listed steelhead in the Touchet River to establish an endemic hatchery stock that would be used for the conservation of listed Touchet River steelhead. A summary of the number and location of fish released from these hatchery programs can be found in Table 1.

Upon final determination, NMFS would provide a letter of concurrence to the USFWS, specifying appropriate reporting requirements. NMFS' concurrence would require the USFWS to comply with HGMP reporting requirements, as defined in the letter of concurrence. The USFWS would evaluate whether the HGMPs' objectives are being accomplished and report regularly to NMFS. A comprehensive review of each HGMP is required of the USFWS every five years. An annual report on the activities and performance of the hatchery programs would be provided to NMFS each year. If monitoring and evaluation indicate that current assumptions are not being met, artificial propagation programs may be adjusted to better meet their purpose and need. Changes could include decreasing production, changing release sites, or acclimating fish before release.

2.3 Additional Options Considered but not Analyzed in Detail

2.3.1 Substantially Increase the Production of Hatchery Fish

The 10 HGMPs have been designed to minimize impacts on ESA-listed fish. Potentially, to increase the availability of hatchery-origin fish designed to be harvested in fisheries, the USFWS could increase production of hatchery fish in several programs without substantially impacting ESA-listed fish. However, most of these programs are at capacity, and an increase in production would require the physical expansion of facilities. Expanding facilities is not within the scope of NMFS' action, and it does not meet the USFWS' need for the action. Additional Lyons Ferry Hatchery steelhead could be produced and released in the Walla Walla and Touchet Rivers without expanding the hatchery facility. However, Lyons Ferry steelhead are not in the Middle Columbia River steelhead ESU, and, as a result, increasing the production of Lyons Ferry fish could have negative impacts on the Middle Columbia River steelhead ESU. Consequently, this option was not considered a reasonable alternative as it did not meet the purpose and need for protecting listed fish.

2.3.2 Substantially Decrease the Production of Hatchery Fish

Decreasing production could potentially reduce incidental impacts on ESA-listed salmon and steelhead. However, impacts of the USFWS artificial propagation programs on ESA-listed salmon and steelhead are being analyzed by NMFS. NMFS does not expect the USFWS's artificial propagation programs to substantially impact any ESA-listed salmon or steelhead populations. Small reductions in production might be expected in the future if the survival of hatchery fish is higher than expected, and any small reductions would be considered in NMFS regular review of the programs. However, at this time, NMFS does not believe that substantially reducing hatchery production would substantially decrease impacts on the environment. As a result, this option was not considered a reasonable alternative as it did not meet the purpose and need of providing fish as mitigation for the construction and continued operation of the Columbia River hydroelectric system.

2.3.3 Remove the Lower Snake River Dams

Two of the USFWS's artificial propagation programs (the Walla Walla and Touchet River steelhead programs) are mitigation for the construction and continued operation of the lower Snake River dams. If the lower Snake River dams were removed, the Lower Snake River Compensation Plan would no longer need to mitigate for losses (in the long term). There has been much regional debate on the removal of the Snake River dams. However, NMFS does not recommend breaching the lower Snake River dams at this time. In addition to scientific uncertainty surrounding the ecological effects of breaching the dams, it would take many years to implement, and its high cost could preclude other reform actions needed throughout the basin. The analysis of effects resulting from removal of the lower Snake River dams is outside the scope of the action considered here. As a result, this option was not considered a reasonable alternative.

3.0 Affected Environment

Both the No Action and Proposed Action alternatives can potentially affect the physical, biological, social, and economic resources within the proposed action area. Below is a summary of the major components of the environment that would be affected by these alternatives and the current baseline condition.

3.1 Physical Environment

The No Action or Proposed Action alternatives could affect the physical environment by impacting the water quality, water quantity, riparian habitat, and the success of fish passage.

3.1.1 Water Quality

Water quality in streams throughout the Columbia River basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the CWA. Most of these water bodies do not meet water quality standards for temperature. Temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that result in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead. Return water from irrigated fields or hatchery facilities could introduce nutrients and pesticides into streams and rivers.

Salmon and steelhead that return from the ocean and spawn in the Lower Columbia River basin provide an essential source of nutrients to the physical environment. The carcasses of salmon and steelhead that die either prior to or after spawning decompose in the freshwater environment.

This decomposition provides nutrients from the fish's body to organisms in the streams. Freshwater systems in the Pacific Northwest tend to be naturally oligotrophic – they produce relatively small amounts of nutrients and organic matter compared to other regions of the world (Cederholm et al. 2000). Therefore, the importation of marine nutrients can provide a substantial proportion of usable nutrients available to freshwater organisms. Salmon and steelhead are the primary sources of these marine-derived nutrients; the vast majority of an adult salmonid's body mass develops during ocean residence, with the result that the adult salmonid serves to transport these nutrients to the freshwater ecosystem during the return migration. Actions that reduce the numbers of salmonids transporting marine-derived nutrients back to freshwater (such as fishery harvest, restriction in passage at dams or weirs, or poor ocean conditions) would ultimately result in a reduction in the amount of available nutrients, as would actions that reduce the capability of the ecosystem to retain salmon carcasses (such as removal of large woody debris, artificial straightening of channels, or possibly substantial changes in flow regimes).

3.1.2 Water Quantity

Water quantity problems are also an important cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation.

On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density, which can affect timing and duration of runoff. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Many tributaries have been substantially depleted by water diversions. In 1993, fish and wildlife agencies, Tribal, and conservation group experts estimated that 80 percent of 153 Oregon tributaries had low-flow problems (two-thirds caused at least in part by irrigation withdrawals) (OWRD 1993). The NWPPC showed similar problems in many Idaho and Washington tributaries (NWPPC 1992).

3.1.3 Riparian Habitat

Land ownership has played a part in habitat and land-use changes. Federal lands, which compose more than a quarter of the basin, are generally forested and located in the upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993; Frissell 1993; Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992; Spence et al. 1996; ISG 1996). Today, agricultural and urban land development and water withdrawals have altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

3.1.4 Fish Passage

Blockages that stop the downstream and upstream movement of fish exist at many agricultural, hydrosystem, municipal/industrial, hatchery, and flood control dams and barriers. Highway culverts that are not designed for fish passage also block upstream migration. In addition, migrating fish can be diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

3.2 Biological Environment

The biological resources discussed below include salmon, steelhead, trout, and other aquatic and terrestrial species that may be affected by the Proposed Action or No Action alternatives. Salmonids are discussed in greater detail than other aquatic or terrestrial species in our analysis, because they are more likely to interact with artificially propagated salmon and steelhead.

Several terrestrial and aquatic organisms are located within the action area, but they are not expected to be impacted by the proposed artificial propagation activities because they do not encounter salmon or steelhead at any point in their life cycle and are not expected to be affected by any activities associated with the proposed artificial propagation programs. These species include beavers, frogs, and submerged macrophytes, as well as several federally listed species. These listed species include the Oregon chub (*Oregonichthys crameri*; endangered), northern spotted owl (*Strix occidentalis caurina*; threatened), Willamette daisy (*Erigeron decumbens*; endangered), Bradshaw's Lomatium (*Lomatium bradshawii*; endangered), golden Indian paintbrush (*Castilleja levisecta*; threatened), howellia (*Howellia aquatilus*; threatened), Kincaid's lupine (*Lupinus sulphureus*; threatened), and Nelson's checker-mallow (*Sidalcea nelsoniana*; threatened). As a result, these species are not included in the detailed analysis.

Several nonlisted fish species, such as smelt (or eulachon, *Thaleichthys pacificus*), American shad (*Alosa sapidissima*), and lamprey (*Entosphenus tridentata* and *Lampetra ayresi*), may encounter hatchery salmon and steelhead in the migration corridor. However, NMFS does not expect these species to interact with hatchery fish or to be affected by activities associated with the artificial propagation programs. As a result, these species are not included in the detailed analysis either.

3.2.1 Listed Salmonids Found in the Action Area

Middle Columbia River Steelhead

Steelhead in North America are distributed from Northwestern Mexico to the Kuskokwim River in Alaska (Lichatowich 1999). Steelhead exhibit more complex life history traits than other Pacific salmonid species. Some forms of *O. mykiss* are anadromous while others, called rainbow or redband trout, are resident forms that remain permanently in freshwater. Anadromous steelhead usually reside in freshwater for 2 years but have been reported to stay as long as seven years before moving to the ocean. Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age.

The Middle Columbia River steelhead ESU includes all naturally spawned populations of steelhead in tributaries of the Columbia River from the Wind River, Washington and Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington. Excluded are steelhead from the Snake River Basin. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 26,739 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clatsop, Columbia, Crook, Gilliam, Grant, Harney, Hood River, Jefferson, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco, and Wheeler; Washington - Benton, Clark, Columbia, Cowlitz, Franklin, Kittitas, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. This ESU was listed as a threatened species on March 25, 1999 (64 FR 14517).

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type (inland), or summer steelhead, enters freshwater in a sexually immature condition and require several months in freshwater to mature and spawn. The ocean-maturing type (coastal), or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Both summer and winter steelhead occur in British Columbia, Washington, and Oregon; Idaho has only summer steelhead; California is thought to have only winter steelhead (Busby et al. 1996). In the Pacific Northwest, summer steelhead enter freshwater between May and October, and winter steelhead enter freshwater between November and April. All steelhead in the Columbia River basin upstream from the Dalles Dam are summer-run, inland steelhead (Schreck et al. 1986; Reisenbichler et al. 1992; and Chapman et al. 1994). Steelhead in Fifteenmile Creek, Oregon, are genetically allied with inland *O. mykiss* but are winter-run. Winter steelhead are also found in the Klickitat and White Salmon Rivers, Washington.

Steelhead are iteroparous, or capable of spawning more than once before death. Annually, probably from 10-20 percent of the spawning population is composed of repeat spawners. Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, or turbidity are required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn farther upstream than winter steelhead (Behnke 1992). Juveniles typically rear in freshwater from 1 to 4 years before migrating to the ocean. Winter steelhead generally smolt after 2 years in freshwater (Busby et al. 1996).

Life history information for steelhead in this ESU indicates that most middle Columbia River steelhead smolt at 2 years and spend 1 to 2 years in salt water (i.e., 1-ocean and 2-ocean fish, respectively) prior to reentering fresh water, where they remain up to a year prior to spawning (Howell et al. 1985; BPA 1992). Within this ESU, the Klickitat River is unusual in that it produces both summer and winter steelhead, and the summer steelhead are dominated by 2-ocean steelhead, whereas most other rivers in this region produce roughly equal numbers of 1- and 2-ocean steelhead.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, with an estimated run size of 100,000 (WDF et al. 1993). If we assume that other basins had proportionally comparable run sizes given their drainage areas, the total historical run size for this ESU may have been in excess of 300,000. Light (1987) estimated that the steelhead run returning to this ESU in the early 1980s was below 200,000, of which approximately 80 percent was of hatchery origin. By 1996, the 5-year average run size was 142,000, of which approximately 73 percent were of hatchery origin (NMFS 1996).

Lower Columbia River Steelhead

The Lower Columbia River steelhead ESU includes all naturally produced steelhead in tributaries to the Columbia River between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, excluding steelhead in the upper Willamette River above Willamette Falls (which are considered part of the Upper Willamette River ESU; Busby et al. 1996). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 5,017 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, and Washington; Washington - Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum. This ESU was listed as a threatened species on March 19, 1998 (63 FR 13347).

Steelhead in this ESU belong to the coastal genetic group (Schreck et al. 1986; Reisenbichler et al. 1992; Chapman et al. 1994) and include both winter steelhead (Cowlitz, Toutle, Coweeman, Kalama, Washougal, Sandy, Hood, Clackamas and Wind rivers) and summer steelhead (Kalama, Lewis, Hood, Wind, and Washougal Rivers). WDF et al. (1993) identified 19 stocks considered to be predominantly of natural production. Hatchery programs that use local natural stocks of winter steelhead have been developed in the Cowlitz River, Kalama River, Sandy River, Clackamas River, and Hood River basins.

Life history attributes for steelhead within this ESU appear to be similar to those of other west coast steelhead. Most Lower Columbia River steelhead rear two years in freshwater and spend one or two years in the ocean prior to re-entering fresh water, where they may remain up to a year prior to spawning (Howell et al. 1985; BPA 1992).

No estimates of historical abundance (pre-1960s) specific to this ESU are available. Abundance trends are mixed and may be affected by short-term climate conditions. There has been a general increasing trend for the naturally produced steelhead populations in this ESU from the lows observed in 1996, with some populations rebounding quicker than others (WDFW 2001; ODFW 2001c; ODFW 2001d).

<u>Lower Columbia River Chinook Salmon</u>
Chinook salmon, also known by the common names king, spring, quinnat, and tyee salmon, historically ranged from the Ventura River in California to Point Hope, Alaska, in North America (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970).

The Lower Columbia River chinook salmon ESU includes all natural-origin populations residing below impassable natural barriers from the mouth of the Columbia River to the crest of the Cascade Range just east of Hood River in Oregon and the White Salmon River in Washington (March 24, 1999, 64 FR 14308). The historic site of Celilo Falls, east of the Hood River in Oregon is considered the eastern boundary of this ESU since it may have been a migrational barrier to chinook at certain times of the year (Myers et al. 1998). This ESU is located in portions of Clark, Cowlitz, Skamania, and Wahkiakum Counties in Washington, and in portions of Clatsop, Columbia, Multnomah, Hood River, and Clackamas Counties in Oregon. The Cowlitz, Kalama, Lewis, Washougal, and White Salmon Rivers constitute the major systems in Washington; the lower Willamette, Hood, and Sandy Rivers are the major systems in Oregon. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,338 square miles in Oregon and Washington (NMFS 2002). This ESU was listed as a threatened species on March 24, 1999 (64 FR 14308).

The ESU does not include spring populations in the Clackamas River, in the Willamette River above Willamette Falls, or the introduced Carson spring chinook salmon strain in the Wind River. Tule fall chinook salmon in the Wind and Little White Salmon Rivers and fall chinook produced at the Spring Creek National Fish Hatchery are included in this ESU, but not introduced upriver bright fall chinook salmon populations in the Wind and White Salmon Rivers. WDF et al. (1993) identified 20 stocks within the ESU, but surveyed only Washington stocks, which did not include the Clackamas tule, Sandy spring, or Sandy fall bright spawning aggregations in Oregon. NMFS is currently engaged in delineating the population structure of this and other ESUs as an initial step in a formal recovery planning effort that is now underway.

Of the Pacific salmon, chinook salmon is the largest of the salmon species in body size and exhibits one of the most diverse and complex life history strategies. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" chinook salmon migrate to the ocean within their first year. Healey (1983; 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

Chinook salmon may spend one to six years in the ocean before returning to their natal streams to spawn. Most of the salmon in Oregon and Washington mature as three to five year old adults (Myers et al. 1998). Ocean distribution differs between ocean- and stream-type chinook, where ocean-type chinook tend to migrate along the coast, and stream-type chinook migrate far from the coast in the central North Pacific (Healey 1983; 1991). Chinook populations south of Cape Blanco tend to migrate to the south, while those north of Cape Blanco tend to migrate in a northerly direction (Myers et al. 1998). Chinook salmon populations can be characterized by their time of freshwater entry as spring, summer, or fall runs. Spring chinook tend to enter freshwater and migrate far upriver, where they remain and become sexually mature before spawning in the late summer and early autumn. Fall chinook enter freshwater in a more advanced stage of sexual maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of their natal rivers and spawn within a few days or weeks of freshwater entry (Fulton 1970; Healey 1991). Summer chinook are intermediate between spring and fall runs, spawning in large and medium-sized tributaries, and not showing the extensive delay in maturation exhibited by spring chinook (Fulton 1970).

A large downstream movement of chinook salmon fry immediately after emergence is typical of most populations (Lister and Walker 1966; Reimers 1971; Kjelson et al. 1981). The downstream migration of both stream- and ocean-type chinook salmon fry (when spawning grounds are well upstream) is probably a dispersal mechanism that helps distribute fry among suitable rearing habitats (Groot and Margolis 1991). Murphy et al. (1989) sampled various riverine habitat types in the lower Taku River and found that there was little overlap in chinook salmon rearing habitat with that of coho or sockeye salmon. Velocity and turbidity were the primary factors associated with chinook salmon distributions. This habitat segregation probably reduces competition between cohabiting chinook and other stream salmonids.

Predators are commonly implicated as an important agent of mortality for chinook salmon and other salmonid species. Heavy losses to predators have been documented in some instances. Sculpins have been reported as an important predator species (Patten 1971). The principal foods of chinook salmon while rearing in freshwater appear to be juvenile and adult insects (Kjelson et al. 1981). Their basic diet is similar to that of coho, steelhead, and other stream dwelling salmonids (Mundie 1969; Chapman and Bjornn 1969).

There are three different historic runs of chinook salmon in this ESU: spring-run, late fall brights, and early fall tules. Lower Columbia River chinook mature from two to six years of age, primarily returning as three- and four-year-old adults (Myers et al. 1998). Spring-run chinook salmon on the lower Columbia River, like those from coastal stocks, enter freshwater in March and April, well in advance of spawning in August and September. Historically, fish migrations were synchronized with periods of high rainfall or snow melt to provide access to upper reaches of most tributaries where spring stocks would hold until spawning (Fulton 1970; Olsen et al. 1992; WDF et al. 1993). Fall run fish do not enter the Columbia River until August.

Estimated overall abundance of chinook salmon in this ESU is not cause for immediate concern. However, about half of the populations comprising this ESU are very small, increasing the risk of genetic loss and a reduction in spatial distribution. Long-term trends in fall run escapement are mixed, with most larger stocks positive, while the spring run trends are positive or stable. Short-term trends for both runs are increasing (WDFW 2001). Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations.

Spring chinook were present historically in the Sandy, Clackamas, Hood, Cowlitz, Kalama, and Lewis rivers (Clackamas River spring chinook are considered part of the listed Upper Willamette River chinook ESU). Spawning and juvenile rearing areas have been eliminated or greatly reduced by dam construction on all these rivers. The native Lewis run became extinct soon after completion of Merwin Dam in 1932. The natural Hood River spring chinook population was extirpated in the 1960's after a flood caused by the natural breaching of a glacial dam resulted in extensive habitat damage in the West Fork production areas. Currently, non-listed hatchery spring chinook from the Deschutes River are being released into the Hood River as part of an experimental reintroduction program. The current spring chinook stocks in the Lower Columbia River ESU are found in the Sandy, Lewis, Cowlitz, and Kalama Rivers. Numbers of naturally spawning spring-run chinook salmon are very low. Hatchery spring chinook salmon continue to be planted in these areas. Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998a). Hatchery-origin spring chinook are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is relatively low, on the order of 10-20 percent in recent years. Hatchery escapement goals have been consistently met in the Cowlitz and Lewis Rivers. In the past, when it was necessary, brood stock from the Lewis River was used to meet production goals in the Kalama River.

Fall chinook populations in the Lower Columbia River are self-sustaining and escapements are generally stable (ODFW 1998a). All medium to large tributaries in the area once had native populations of fall chinook. The tule component of the fall chinook populations spawn in the Coweeman, East Fork Lewis, and Clackamas Rivers. Escapements for these populations have averaged several hundred to 1,000 per year (data provided by C. LeFleur, WDFW, to S. Bishop, NMFS, April 9, 2000). Some natural spawning of tule fall chinook occurs in other areas but is thought to result primarily from hatchery-origin strays. Tule fall chinook are produced from the Elochoman, Cowlitz, Toutle, Kalama, Spring Creek, and Washougal hatcheries in Washington and Big Creek hatchery in Oregon. The late fall bright component of Lower Columbia River chinook spawn in the North Fork Lewis, Sandy, and East Fork Lewis Rivers. Lower Columbia River bright stocks are among the few healthy natural chinook stocks in the Columbia River basin. Returns to the North Fork Lewis River have exceeded the escapement goal of 5,700 by a substantial margin every year since 1980 (except 1999) with a recent five year average escapement of 8,400. Escapements of the two smaller populations of brights in the Sandy and East Fork Lewis River have been stable for the last 10-12 years and are largely unaffected by hatchery fish (ODFW 1998a).

Many of the chinook salmon stocks in these ESUs have been in decline for decades (Myers et al. 1998). Factors implicated in the decline of the species include dams, logging, agriculture, water withdrawal, mining, and urbanization, all of which contribute to habitat loss and degradation, overfishing, and the wide use of hatcheries and other forms of artificial propagation, which may reduce the genetic integrity of the wild stocks (Myers et al. 1998). In addition, sources suggest that the “inadequacy of existing regulatory mechanisms” is a general reason for overall decline in abundance of chinook salmon (Oregon Natural Resources Council and Nawa 1995). Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat (Myers et al. 1998).

Upper Willamette River Spring Chinook Salmon

The Upper Willamette River spring chinook salmon ESU is currently listed as threatened (March 24, 1999, 64 FR 14308). Historically, there were five major basins that produced Upper Willamette River spring chinook salmon including the Clackamas, North and South Santiam, McKenzie, and the Middle Fork Willamette Rivers. Dams on the South Fork Santiam and Middle Fork Willamette eliminated wild spring chinook in those systems (ODFW 1998b). Although there is still some natural spawning in these systems below the dams, habitat quality is such that there is probably little resulting production and the spawners are likely of hatchery origin. Populations in several smaller tributaries that also used to support spring chinook are believed to be extinct (Nicholas 1995). The McKenzie, Clackamas, and North Santiam basins are therefore the primary basins that continue to support natural production. Of these, the McKenzie is considered the most important. Prior to construction of major dams on Willamette tributaries, the McKenzie River basin produced 40 percent of the spring chinook above Willamette Falls and it may now account for half the production potential in the Basin. Although five Willamette River spring-run hatchery stocks were included in the ESU, none were considered essential for recovery (March 24, 1999; 64 FR 14308).

The abundance of naturally-produced spring chinook in the ESU has declined substantially from historic levels. Historic escapement levels may have been as high as 200,000 fish per year (Myers et al. 1998). Total abundance has been relatively stable at approximately 20,000 to 30,000 fish. From 1946-50, the geometric mean of Willamette Falls counts for spring chinook was 31,000 fish, which represented primarily naturally-produced fish. The most recent 5-year average total escapement above the falls was 32,500 fish, but comprised predominantly of hatchery-produced fish (NMFS 2001). Current natural escapement is less than 5,000 fish and about two-thirds of the natural spawners are estimated to be first-generation hatchery fish. This suggests that the natural population is falling far short of replacing itself even in the absence of fisheries (Myers et al. 1998).

Although natural escapements are depressed, the number of naturally spawning fish has gradually increased in recent years (NMFS 2001). The number of natural-origin fish crossing Leaburg Dam has increased steadily from 800 in 1994 to about 1,400 in 1999 and 2,000 in 2000, compared with the interim escapement goal of 3,000-5,000 (ODFW 1998b). Most of the natural spawning on the Clackamas River occurs above the North Fork Dam with 900 -2,200 adults crossing the Dam in recent years, compared with an interim escapement goal of 2,900 adults (ODFW 1998b). Over 70 percent of the production capacity of the North Santiam system was blocked by the Detroit Dam (built in 1953). There are no passage facilities at the Detroit Dam, so all of the current natural production potential remains downstream. There were 194 redds counted in this area in 1998, 221 in 1999 and 345 in 2000, compared to an average of 140 in the 1996 and 1997 years (ODFW/WDFW 2000; ODFW 2001a).

The primary cause of decline of chinook salmon in this ESU is the blockage of access to large areas of spawning and rearing habitat by dam construction. The remaining habitat has been degraded by thermal effects of dams, forestry practices, agriculture, and urbanization. Another concern for this ESU is that commercial and recreational harvest were high, relative to the apparent productivity of natural populations (Myers et al. 1998).

Columbia River Chum Salmon

Historically, chum salmon (*Oncorhynchus keta*) were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast (Johnson et al. 1997). Also known as dog salmon, chum salmon are the second largest Pacific salmonid in body size after chinook and may have also been the most abundant salmonid. It is estimated that, prior to the 1940s, chum salmon accounted for almost 50 percent of the total Pacific Ocean salmonid biomass. This ESU was listed as a threatened species on March 25, 1999 (64 FR 14508).

The Columbia River chum salmon ESU includes all naturally produced populations that enter the Columbia River. The Columbia River chum salmon ESU occurs in portions of Clark, Cowlitz, Lewis, and Wahkiakum Counties in Washington, and Clatsop, Columbia, and Multnomah Counties in Oregon.

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum spend two to five years in northeast Pacific Ocean feeding areas prior to migrating southward during the summer months as maturing adults along the coasts of Alaska and British Columbia in returning to their natal streams (WDFW and PNPT 2000). Most chum salmon mature as four year old adults (Johnson et al. 1997). Chum salmon usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to salt water almost immediately after emerging from the gravel that covers their redds (Salo 1991). It is not clear to what extent chum fry feed as they migrate down the larger rivers because only a few cases of feeding have been documented. This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986).

The information on ocean migration patterns and distribution is limited and no region-specific information for this ESU is available (Johnson et al. 1997). There is some speculation that Columbia River chum salmon had a more southerly ocean distribution similar to the present-day distribution and migration pattern of Columbia River coho (Sandercock 1991). Grays River chum salmon enter the Columbia River from mid-October to mid-November, but apparently do not reach the Grays River until late October to early December. These fish spawn from early November to late December. Fish returning to Hamilton and Hardy Creeks begin to appear in the Columbia River earlier than Grays River fish (late September to late October) and have a more protracted spawn timing (mid-November to mid-January).

The Columbia River chum salmon ESU historically contained large runs of chum salmon that supported a substantial commercial fishery in the first half of the century. More than 500,000 chum salmon were harvested in some years. Historically, chum salmon were abundant in the lower reaches of the Columbia River and may have spawned as far upstream as the Walla Walla River (over 500 km inland). Currently, chum salmon are limited to tributaries below Bonneville

Dam, with the majority of fish spawning on the Washington side of the Columbia River. Many lower Columbia tributaries once produced chum salmon, however, substantial chum salmon natural production is currently limited to just two areas: Grays River near the mouth of the Columbia River, and the Hamilton/Hardy/Duncan Creeks group and Ives Island, which are just downstream of Bonneville Dam. Small numbers of adult chum salmon have been observed in several other lower Columbia River tributaries. ODFW has identified 23 historical spawning populations on the Oregon side of the Columbia River, but they do not have estimates of abundance and consider Oregon chum salmon populations to be very depressed to extinct (Kostow 1995). In 2000, only one chum salmon was observed during stream surveys in the Oregon tributaries (WDFW 2001; ODFW 2001b). A few chum salmon cross Bonneville Dam in some years, but these are likely lost to the system as there are no known spawning areas above Bonneville Dam. Although current abundance is only a small fraction of historical levels, and much of the between population diversity has presumably been lost, the total spawning run to the Columbia River has been relatively stable since the mid 1950's, and total natural escapement for the ESU is probably at least several thousand fish per year. In 2001, the Washington Department of Fish and Wildlife estimated that 10,000 chum salmon returned to the Columbia River, and they predict that as many as 30,000 adult chum salmon may have returned in the 2002 season.

Decline of this ESU is attributed to dams and habitat degradation primarily due to diking and wetland loss (Sherwood et al. 1990; Johnson et al. 1997). Hatchery fish have likely had little influence on the wild component of the Columbia River chum salmon ESU because there is only limited production of hatchery chum salmon in the Columbia River Basin (Johnson et al. 1997). The retention of chum salmon in fisheries has been prohibited in all Oregon-side Columbia River tributaries since 1992, and in Washington-side tributaries since 1995.

Bull Trout

Another ESA-listed fish species that could be present in the action area is bull trout (*Salvelinus confluentus*). The Columbia River population segment encompasses a vast geographic area including portions of Idaho, Montana, Oregon, Washington, and British Columbia.

Bull trout populations are known to exhibit four distinct life history forms: resident, fluvial, adfluvial, and anadromous. Resident bull trout spend their entire life cycle in the same (or nearby) streams in which they were hatched. Fluvial and adfluvial populations spawn in tributary streams where the young rear from one to four years before migrating to either a lake (adfluvial) system or a river (fluvial) system, where they grow to maturity. Anadromous fish spawn in tributary streams, with major growth and maturation occurring in salt water.

Bull trout, in general, prefer cold water streams with temperatures below 15°C (Reiman and McIntyre 1993). The Oregon Department of Fish and Wildlife conducted stream surveys in Shitike Creek in 2001 and found very low abundances of juvenile spring chinook salmon in the upper reaches of the river despite relatively high densities of redds. Juvenile spring chinook salmon were found predominantly in the lower sections of the river, while bull trout were found predominantly in the upper sections. Temperature is believed to be one factor that segregates juvenile bull trout and juvenile spring chinook salmon (Dambacher 2002).

Bull trout are estimated to have occupied about 60 percent of the Columbia River basin at one time, but presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). Middle Columbia River tributaries contain 21 subpopulation of bull trout: White Salmon River (1), Klickitat River (1), Deschutes River (3), John Day River (3), Umatilla River (2), Walla Walla River (3), and Yakima River (8)). However, some of these subpopulations occur above barriers impassable to anadromous fish and are, therefore, not within the boundaries of the Middle Columbia River steelhead ESU. Historically, bull trout were found in several rivers within the boundaries of the Lower Columbia River ESUs. However, currently, bull trout are only found in the Hood and Lewis Rivers (CBFWA 2002). Bull trout are uncommon within the boundaries of the Upper Willamette River spring chinook salmon ESU and in the mainstem Columbia River. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of nonnative species. The Columbia River population segment of bull trout was listed as threatened by the USFWS in 1998 (June 10, 1998, 63 FR 31647). All bull trout encountered by anglers within the boundaries of the Lower Columbia River and Middle Columbia River ESUs must be released unharmed.

3.2.2 Listed Salmonids Found Outside of the Action Area

Several Federally listed populations of salmon and steelhead spawning and rearing outside the action area could interact in the migration corridor with hatchery salmon and steelhead produced in the proposed artificial propagation programs. These populations may include Snake River fall chinook salmon (threatened), Snake River spring/summer chinook salmon (threatened), Upper Columbia River spring chinook salmon (endangered), Snake River sockeye salmon (endangered), Upper Columbia River steelhead (endangered), and Snake River steelhead (threatened).

The life histories of chinook salmon and steelhead outside of the action area are similar to the life histories of these species within the action area (see section 3.2.1). However, sockeye salmon are not found within the action area. Sockeye salmon exhibit a greater variety of life history patterns than either chum, coho, or chinook salmon. The vast majority of sockeye salmon spawn in either inlet or outlet streams of lakes or in lakes themselves. The offspring of these “lake-type” sockeye salmon utilize the lake environment for juvenile rearing for 1, 2, or 3 years and then migrate to the ocean. However, some populations of sockeye salmon spawn in rivers without juvenile lake rearing habitat. The offspring of these riverine spawners utilize the lower slow-velocity sections of rivers as the juvenile rearing environment for 1 to 2 years (“river-type”sockeye salmon), or migrate to the sea as underlings after spending only a few months in the natal river and, therefore, rear primarily in saltwater (“sea-type” sockeye salmon; Foerster 1968; Wood 1995).

Sockeye passing though the Lower Columbia River and Middle Columbia River migration corridor would be from the Snake River, Lake Wenatchee, or Okanogan River ESUs. The Lake Wenatchee and Okanogan ESUs are not listed under the ESA, although the entire Columbia basin has seen a considerable decline in sockeye salmon abundance since the turn of the twentieth century (NMFS 1997). Historically, sockeye salmon from the Snake River basin were abundant in several lake systems in Idaho and Oregon. In the last century, a variety of factors (including overfishing, irrigation diversions, obstacles to migration, and eradication through poisoning) have led to the demise of all Snake River sockeye except those returning to Redfish Lake in the Stanley basin of Idaho (NMFS 1991).

3.2.3 Non-Listed Salmonids

Many other salmonids not currently listed under the ESA are found in the action area.

Coho Salmon

Coho salmon (*Oncorhynchus kisutch*) were historically abundant throughout the Lower Columbia region. On the Oregon side of the Lower Columbia, remnant populations of coho salmon are still present in the Sandy and Clackamas rivers. In recent years, the runs to these rivers have ranged from zero to several hundred fish. The abundance of coho salmon in the 1960's (when monitoring began in these rivers) were typically four to five thousand fish per year and ranged as high as 20,000 fish. The use of Eagle Creek by native coho is not well documented. Although currently there are coho naturally spawning in Eagle Creek, the origin of these fish is unknown (USFWS 2002a). Natural spawning of coho may also occur in other areas such as the Lewis and Clark River, Klaskanine River, Youngs River, Big Creek, Clatskanie River, and Gnat Creek. In 1995, NMFS defined coho in the Columbia River to be part of the Lower Columbia River/Southwest Washington ESU, and determined that listing was not warranted (July 25, 1995, 60 FR 38011). However, the ESU is designated as a candidate for listing, and its status is subject to on-going review. The state of Oregon has listed coho salmon in the Lower Columbia River under the state ESA. On the Washington side, coho salmon spawning occurs primarily in the Grays, Elochoman, Cowlitz, Kalama, and Lewis rivers. Due to the depressed status of wild coho stocks in the Lower Columbia River, fishery impacts have been substantially reduced.

No coho salmon populations of native origin are found within the boundaries of the Middle Columbia River steelhead ESU, though historically such populations did exist. However, coho salmon are being reintroduced into the Yakima and Umatilla Rivers and have been introduced into the Klickitat and Little White Salmon Rivers. Hatchery stocks for these programs are from the Lower Columbia River coho salmon ESU. None of these hatchery stocks are listed under the ESA.

The majority of coho salmon mature in their third year of life, having spent about four to six months in incubation and up to fifteen months rearing in freshwater, followed by a fifteen-month growing period at sea (Sandercock 1991). Juvenile coho normally occupy the slower moving sections of the stream and, like other juvenile salmonids, feed primarily on stream and terrestrial insects (Mundie 1969). At the yearling stage, coho may become predatory and supplement their insect diet with fry of their own or other species (Gribanov 1948). Shapovalov and Taft (1954) reported that, in California, steelhead and coho fry were not subject to coho yearling predation , because they emerged from the gravel after the coho smolts had migrated to sea. However, large numbers of chinook fry were taken by the coho outmigrants. Chamberlain (1907) and Zorbidi (1977) both reported that larger coho fed on three-spine sticklebacks (*Gasterosteus aculeatus*), in addition to terrestrial and aquatic insects. Sculpins (*Cottus* sp), and bull trout (Salvelinus malma), and mountain whitefish (*Prosopium williamsoni*) are all important predators of juvenile coho (Larkin 1977).

<u>Rainbow and Redband Trout</u>
There are both resident and anadromous forms of *O. mykiss*. Anadromous forms are termed steelhead, whereas the resident forms are referred to as rainbow or redband trout. Both redband and rainbow trout are common within the action area, and populations are generally considered healthy. However, few detailed studies have been conducted regarding the relationship between resident and anadromous *O. mykiss* and, as a result, the relationship between these two life forms is poorly understood. As juveniles, redband trout, rainbow trout, and steelhead are virtually indistinguishable. Anecdotal reports suggest that interbreeding between the two forms is possible. Only anadromous forms of *O. mykiss* are listed under the ESA at this time (March 25, 1999, 64 FR 14517).

<u>Cutthroat Trout</u>
Coastal cutthroat (*Oncorhynchus clarki clarki*) are present throughout the Lower Columbia and Upper Willamette regions. Coastal cutthroat exhibit a wide range of life history strategies. The three basic variations include a resident or primarily non-migratory form, freshwater migrants, and marine migrants (sea-run) (Hall et al. 1997). Resident forms stay within the same stream reach their entire life. Freshwater migrants typically move from small tributaries to larger streams or to lakes and reservoirs. Marine migrants move from their natal stream to estuarine and nearshore, coastal areas for a period of time. Current abundance of cutthroat trout is lower than historical levels; however, information is sparse throughout the region. The USFWS concluded the Southwestern Washington/Columbia River Distinct Population Segment did not warrant listing under the ESA (July 5, 2002, 67 FR 44934). Coastal cutthroat are found only in the Klickitat and White Salmon Rivers of the Middle Columbia River.

The westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is 1 of 14 subspecies of cutthroat trout native to the interior regions of North America (Behnke 1992). Characteristics of the cutthroat trout that distinguish this fish from other cutthroat subspecies include a unique pattern of spots on the body, a unique number of chromosomes, and other genetic and morphological traits that appear to reflect a distinct, evolutionary lineage. The USFWS determined that listing this subspecies was not warranted (April 14, 2000, 65 FR 20120). Westslope cutthroat trout are found in the John Day River drainage of the Middle Columbia River. Westslope cutthroat trout are not found within the boundaries of the Lower Columbia River and Upper Willamette River ESUs.

Spring Chinook Salmon

The Middle Columbia River spring chinook ESU includes stream-type chinook salmon spawning in the Klickitat, Deschutes, John Day, and Yakima Rivers. Historically, spring-run populations from the Walla Walla and Umatilla Rivers may have also belonged in this ESU, but these populations are now considered extinct. Chinook salmon from this ESU emigrate to the ocean as yearlings and apparently migrate far off-shore, as they do not appear in appreciable numbers in any ocean fisheries. The majority of the adults spawn as 4-year-olds, with the exception of fish returning to the upper tributaries of the Yakima River, which return predominantly at age 5. Populations in this ESU are genetically distinguishable from other stream-type chinook salmon in the Columbia and Snake Rivers. The Yakima and John Day Rivers have substantial run sizes, but several stocks within this ESU have been identified as at risk or extinct. Despite low abundances relative to estimated historical levels, long-term trends in abundance have been relatively stable in this ESU. As a result, NMFS concluded that spring chinook salmon in the Middle Columbia River ESU are not presently in danger of extinction, nor are they likely to become endangered in the foreseeable future (March 9, 1998, 63 FR 11489).

Summer and Fall Chinook

Lichatowich (1998) has suggested that summer-run fish existed in the Deschutes River. In the 1960s, three returning adults that were tagged while passing Bonneville Dam during July were later recovered in the Metolius River, a tributary to the Deschutes River (Rkm 179; Galbreath 1966). Genetic samples indicate that a vestigial run of summer-run fish remain in the Deschutes River (March 9, 1998, 63 FR 11482). These fish have retained the propensity to migrate farther upstream than fall-run fish. Summer chinook are included in the non-listed Deschutes River summer/fall chinook ESU. Fall chinook are also found in the Yakima River. These fall chinook are part of the non-listed Upper Columbia River summer/fall-run chinook salmon ESU. Other non-listed fall chinook salmon are found in the action area, but these populations were derived from introduced hatchery stocks.

Whitefish

Mountain whitefish (*Prosopium williamsoni*) are native and common within the action area. For the most part, they are still found in their original distribution pattern with the exception of waters that were chemically treated and recolonization did not occur. Mountain whitefish broadcast spawn over gravel areas of streams in the late fall or early winter. They do not build redds and prefer cold spring-fed streams for spawning. Juvenile whitefish hatch in the spring (March-April). Mountain whitefish prefer large lakes or large rivers where they are generally found in the deep pools in schools of up to several hundred fish. They are primarily bottom feeders consuming aquatic insects and can be direct competitors with salmon, steelhead, and trout. They are considered to be a barometer of good water quality and have adapted well to habitat alterations.

3.2.4 Non-salmonid Fish Species

Sturgeon

Two species of sturgeon are found in the Columbia River, the white (*Acipenser transmontanus*) and the green (*A. medirostris*). Green sturgeon are more marine-associated than white sturgeon, and are harvested almost exclusively in the fall season commercial gill-net fishery in the lower Columbia River. The green sturgeon was recently petitioned for listing under the ESA, but NMFS found that listing was not warranted at this time (January 29, 2003, 68 FR 4433).

The white sturgeon is the more valuable species in river fisheries because of its larger size and higher-quality flesh. The white sturgeon population below Bonneville Dam is considered healthy and productive, while the health of those populations above Bonneville Dam are considered to be improving but still depressed, due to their segmented nature resulting from reservoir impoundments. Recreational and commercial fisheries in the lower Columbia River were constrained in the late 1980's to prevent overharvest and allow additional recruitment into the legal-sized portion of the population. Increased abundance, and adjustments in the size limits in recent years, have allowed harvest to increase for both recreational and commercial fisheries. Anecdotal evidence suggests that white sturgeon may feed on juvenile salmon that are killed passing through dams.

Northern Pikeminnow

Northern pikeminnow *(Ptychocheilus oregonensis)* are abundant in the Columbia River basin. They are the most abundant predator species in the Columbia River system. They tend to concentrate in the tailrace areas of the mainstem dams during the juvenile migration salmonid migration period, holding in relatively slow-moving water areas near passage routes.

Sculpins

Several species of sculpin (*Cottus* spp.) are native and commonly found in the Columbia River basin. Sculpin have been known to prey on salmonid eggs and fry of salmon (Morrow 1980).

Dace

Several species of dace (*Rhinichthys* spp.) are commonly found in the Columbia River basin. Generally, they inhabit flowing pools and gravel runs of creeks and small to medium rivers. They feed mostly on aquatic and terrestrial insects.

Suckers

Several species of suckers (*Catostomus* spp.) are native to the Columbia River basin. Suckers are found in various habitats, but most common in rocky riffles and runs of clear mountain creeks. Spawning adults may be preyed upon by upon by birds and mammals, while small individuals might be preyed upon by stream salmonids (Scott and Crossman 1973). The mountain sucker (*Catostomus platyrhynchus*) is a candidate for listing as threatened or endangered by WDFW (WDFW 2002c).

Redside Shiners

Redside shiners (*Richardsonius balteatus*) are native and abundant in the Columbia River basin. Fry feed on zooplankton and algae, and adults feed on insects, snails, zooplankton, and at times may consume fish eggs and fry (Jacobs et al. 1996). Predation on salmon fry may occur in the nearshore environment and in tributaries. Redside shiners are known to exhibit diel migration patterns between nearshore and pelagic habitats, and may compete with juvenile salmon for zooplankton when in pelagic areas.

Three-Spine Stickleback

Threespine sticklebacks (*Gasterosteus aculeatus*) often overlap in diet and distribution with salmonids. In addition, Chamberlain (1907) and Zorbidi (1977) both reported tht larger juvenile coho (12.3-13.7 cm) fed on three-spine sticklebacks. Three-spine sticklebacks are native to the Columbia River basin and abundant in the area.

Warmwater Fish Species

Many introduced warmwater fishes (family Centrarchidae) are found in the Columbia River and its tributaries. The most popular fisheries target bass, crappie, walleye, and bluegill. These species are most abundant in standing water bodies and in the mainstem Columbia River. These warmwater fish species are predators of salmon and steelehead within the action area.

3.2.5 Piscivorous Birds

Many piscivorous birds inhabit or migrate through the action area. Species present include American peregrine falcons (*Falco peregrinus anatum*), bald eagles (*Haliaeetus leucocephalus*; listed as threatened under the ESA), belted kingfishers (*Ceryle alcyon*), great blue herons (*Ardea herodias*), green herons (*Butorides striatus*), harlequin ducks (*Histrionicus histrionicus*), common mergansers (*Mergus merganser*), osprey (*Pandion haliaetus*), Caspian terns (*Sterna caspia)*, cormorants (*Phalacrocorax* spp.), and gulls (family Laridae). Salmonids represent a varying proportion of their diet, and no species depends exclusively on salmonid prey. Increasing populations of piscivorous birds (primarily Caspian terns) nesting on islands in the Columbia River estuary consume large numbers of juvenile salmonids and thus constitute one of the factors that currently limit salmonid stock recovery (Roby et al. 1998).

3.2.6 Other Aquatic and Terrestrial Species

Many other aquatic and terrestrial species are found in the action area, such as river otters (*Lutra canadensis*), harbor seals (*Phoca vitulina*), black bears (*Ersus americanus*), sea lions (*Zalophus californianus),* raccoons (*Procyon lotor*), mountain lions (*Puma concolor)*, and mink *(Mustela vison*). These species could feed on salmon and steelhead produced in the proposed artificial propagation programs. All of these species are relatively abundant in the action area.

Following the passage of the Marine Mammal Protection Act in 1972, both the sea lion and harbor seal populations have steadily increased on the West Coast of the U.S. Recent preliminary analysis by NMFS indicates that the harbor seal population on the Washington/Oregon coast has reached optimal sustainable production level (OSP). The West Coast sea lion population is also very large and may be greater than any time for which we have records; however, there is no evidence that it has reached OSP. With the increase in sea lion and harbor seal populations, there has been increased concern over the impact of these animals on depressed and declining salmon and steelhead populations (NMFS 1998).

Several species of aquatic insects are also found in the action area, including those of the families Tricoptera, Ephemeroptera, Diptera, Coleoptera, and Odonata. These species may be eaten by fish produced in the proposed artificial propagation programs. All of these insect species are generally abundant in the action area.

3.3 Social and Economic Environment

Columbia River salmon and steelhead have been central to American Indian life for thousands of years. Although Indians continue their pursuit of salmon for sustenance, commerce, and as part of their cultural heritage, many of their historic fishing spots have been destroyed by federal dams. Prior to the completion of The Dalles Dam in 1957, treaty Indians and non-Indians both had commercial fisheries in the mainstem Columbia River from 15 miles above Bonneville Dam to the mouth of the Deschutes River. The treaty Indian dipnet fishery at Celilo Falls and nearby fishing sites accounted for most of the catch. After the completion of The Dalles Dam just downstream of Celilo Falls, treaty Indian fishing sites were inundated, virtually eliminating the dipnet fishery and further affecting run sizes and compositions to areas upstream of the dam. The current treaty Indian fishing area in the Columbia River mainstem was established in 1969 and is located between Bonneville and McNary Dams. Other important tribal fishing areas are located on the Klickitat, Yakima, and Umatilla Rivers.

The early history of non-Indian use of fishery resources in the Columbia River Basin was described by Craig and Hacker (1940). Early traders, trappers, and settlers began arriving around 1800. These early immigrants began taking salmon for their own use and consumption, often trading with the Indians to obtain fish. Early attempts at commercial taking of salmon began in 1829, with salmon harvest as a commercial industry beginning in earnest by the mid-1880s. The first cannery on the Columbia River produced its first pack of canned salmon in 1866. By 1887, the number of canneries in the basin peaked at 39. Salting, mild-curing, and other methods of salmon preparation were also taking place, and Columbia River salmon were becoming well-known internationally. The total production of canned, mild-cured, and frozen salmon and steelhead in the Columbia River Basin rose from 272,000 pounds in 1886 to annual productions between 20 and 50 million pounds from 1874 through 1936.

The gear used to fish commercially for Columbia River salmon included gill nets, purse seines, traps, dip nets, fish wheels, and a variety of other methods (Craig and Hacker 1940). The combined gear types landed an average of 24,477,370 pounds of salmon and steelhead annually between 1927 and 1934.

The increased use of gasoline engines on boats enhanced the development of trolling as a commercial salmon harvest method after about 1905, predominantly for chinook and coho salmon. Between 1926 and 1934, the average annual troll catch in the Columbia River was 894,000 pounds of chinook and 2.6 million pounds of coho salmon (Craig and Hacker 1940).

In the early 1900s, increased agriculture, industry, and land development began to reduce the amount of suitable habitat for salmon spawning and rearing. In that period, the annual catch of chinook salmon fluctuated widely. As chinook salmon abundances began to decline, starting around 1911, the focus of commercial harvest operations began to shift to other species. As total salmonid abundances in Columbia River fisheries continued to decline, concerns for the continued health of salmonid stocks increased. Management actions began to be developed and implemented to slow the decline of salmon abundances, including the elimination of fish wheels and purse seines on the Columbia River and the reduction of commercial gillnet seasons. In recent years commercial and recreational fisheries have been considerably reduced from former levels. Nonetheless, the lower and middle Columbia River regions attract many anglers annually and provide substantial economic benefits to local communities from the sale of fishing licenses, boats, tackle, lodging, gasoline, and food.

3.4 Environmental Justice

Executive Order 12898 (59 FR 7629) states that Federal agencies shall identify and address, as appropriate "…disproportionately high and adverse human health or environmental effects of [their] programs, policies and activities on minority populations and low-income populations…." While there are many economic, social, and cultural elements that influence the viability and location of such populations and their communities, certainly the development, implementation and enforcement of environmental laws, regulations and policies can have impacts. Therefore, Federal agencies, including NMFS, must ensure fair treatment, equal protection and meaningful involvement for minority populations and low-income populations as they develop and apply the laws under their juristiction.

In the analysis area, there are minority and low income populations that this Executive Order could apply to, including Native American Indian tribes, and Hispanics. These Tribes include the Confederated Tribes of the Warm Springs Reservation, The Confederated Tribes of Umatilla Reservation, The Confederated Tribes and Bands of the Yakama Nation, and the Nez Perce

Tribe. Hispanic populations traditionally were found in agricultural areas drawn by jobs on farms and in food processing plants. More and more first and second generation Hispanics now live and work in urban areas, where there are increasing employment and business opportunities.

Subsection 3.3, Social and Economic Environment provides further information.

4.0 Environmental Consequences

Environmental assessments were prepared evaluating the effects of NMFS' application of the ESA 4(d) Rule to the Middle Columbia River steelhead, Lower Columbia River steelhead, Lower Columbia River chinook salmon, Upper Willamette River spring chinook salmon, and Columbia River chum salmon ESUs (NMFS 2000a; NMFS 2000b; NMFS 2000c). NMFS determined that the ESA 4(d) Rule and its implementation would not significantly impact the human environment. The analysis and findings in the EAs and Findings of No Significant Impact are incorporated here by reference. The anticipated environmental consequences of this Proposed Action in comparison to the No Action alternative are summarized in Table 2.

Table 2. Effects of the action alternatives on the human environment[1].

Affected Environment	No Action Alternative	Proposed Action Alternative
Physical		
Water Quality	• Slight increase in water quality immediately surrounding the hatchery • Slight reduction in nutrients provided by hatchery fish carcasses.	• Slight decrease in water quality immediately surrounding the hatchery • Slight increase the amount of nutrients provided by hatchery fish carcasses
Water Quantity	• Increased water supply between hatchery intake and outflow structures	• Reduction of water supply between hatchery intake and outflow structures
Riparian Habitat	• No effect	• No effect
Fish Passage	• Some improvement	• Some delay
Biological		
Salmonid Fishes	• Fewer naturally spawning steelhead in the Touchet River • Fewer naturally spawning spring chinook in the Warm Springs River • Decreased competition for food and space • Decreased risk to the genetic integrity of salmonid populations	• More naturally spawning steelhead in the Touchet River. • More naturally spawning spring chinook in the Warm Springs River • Increased competition for food and space • Increased risk to the genetic integrity of salmonid populations
Non-Salmonid Fishes	• Decreased food supply for predators of salmonids • Increased predation on suckers	• Increased food supply for predators of salmonids • Decreased predation on suckers
Piscivorous Birds	• Decreased food supply	• Increased food supply
Seals and Sea Lions	• Decreased food supply	• Increased food supply
Social and Economic	• Decreased fishing opportunities • Decreased economic opportunities	• Increased fishing opportunities • Increased economic opportunities
Environmental Justice	• No disproportional effects on minority or low income population segments	• No disproportional effects on minority or low income population segments

[1] Effects of the No Action alternative are in comparison to environmental baseline, and the effects of the Proposed Action alternative are in comparison to the No Action alternative.

4.1 Alternative 1 (No Action)

If the HGMPs are not approved under the 4(d) Rule, the implementation of the USFWS's artificial propagation programs would likely result in the unauthorized take of ESA-listed anadromous fish species. "Take," according to ESA, is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Harass is further defined as intentional or negligent actions that create the likelihood of injury to ESA-listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. As a result, it is likely that the USFWS would eliminate their artificial propagation programs or substantially alter them to avoid take of listed species, and fewer hatchery fish would be found in the Columbia River basin. The environmental impacts related to these assumptions are identified in the following sections.

4.1.1 Effects on the Physical Environment

Water Quality
Under the No Action alternative, treated hatchery effluent would no longer being passed into the rivers, which could slightly improve the water quality immediately surrounding the hatchery. However, hatchery effluent is quickly diluted and is not expected to adversely affect the biological environment. As a result, under the No Action alternative, the expected elimination of hatchery effluent into the rivers would not be expected to have an appreciable effect on the long-term health of the ecosystem.

Under the No Action alternative, fewer fish carcasses would be left in the ecosystem to provide nutrients to aquatic organisms, including listed salmon and steelhead.

Water Quantity
Under the No Action alternative, NMFS would not expect any change in water quantity, because the proposed hatchery programs that would be eliminated under the No Action alternative do not affect water quantity. However, during low water years, a small portion of the Wind River may be dewatered between the hatchery intake and outflow structures. Under the No Action alternative, dewatering at the hatchery would not likely occur.

Riparian Habitat
NMFS would not expect any change in the riparian habitat as a function of the No Action alternative, because no structures would be built or removed in the riparian area. NMFS does not expect that any weirs would be built or removed as a result of the No Action alternative. The Dayton trap on the Touchet River may be removed under the No Action alternative, but removal would not be expected to have any appreciable affect on the riparian habitat.

Fish Passage
Fish passage for wild fish could be improved under the No Action alternative if weirs associated with hatchery operations were removed. Under the No Action alternative, NMFS does not expect that any weirs would be removed because they allow for the monitoring of fish populations. The passage facility operated in conjunction with the weir at Little White Salmon Fish Hatchery on the Little White Salmon River would likely be left open to allow continual passage of anadromous fish. However, very little spawning habitat is located above the weir, so NMFS would not expect this action to have any appreciable affect on anadromous fish populations.

4.1.2 Effects on the Biological Environment

Listed and Non-Listed Salmonids Within and Outside the Action Area
Under the No Action alternative, NMFS assumes that the proposed hatchery programs would be eliminated. All of the proposed hatchery programs would provide fish for harvest. However, the Warm Springs spring chinook and the Touchet River summer steelhead programs would also allow hatchery fish to spawn naturally. These programs have a dual purpose of harvest augmentation and conservation. The cessation of these programs could lead to a decline in natural populations. In addition, fall chinook from the Spring Creek National Fish Hatchery spawn in the Wind, Hood, and White Rivers. These native tule fall chinook populations may go extinct without a constant influx of Spring Creek hatchery fish.

Non-Salmonid Fish Species
Most non-salmonid fish found within the action area are potential predators on salmon and steelhead. However, no fish species feeds solely on salmon and steelhead. One non-salmonid fish species, the sucker, is a potential prey item for salmon and steelhead, but the sucker is not a major component of any salmon or steelhead diet. As a result, the No Action alternative would not be expected to have much impact, if any, on non-salmonid fish populations.

Piscivorous Birds and Other Aquatic and Terrestrial Resources
Increasing populations of piscivorous birds (primarily Caspian terns) nesting on islands in the Columbia River estuary consume large numbers of juvenile salmonids and thus constitute one of the factors that currently limits salmonid stock recovery (Roby et al. 1998). The No Action alternative would result in fewer fish prey for piscivorous birds and many other aquatic and terrestrial predators such as seals and sea lions. It has been suggested that reducing hatchery releases may reduce piscivorous bird populations. However, no predator feeds exclusively on salmon or steelhead, and most predators generally adapt their foraging behavior to take advantage of the most plentiful species. In addition, the 10 proposed programs release 25,195,000 salmon and steelhead into the Columbia basin annually. These fish are only a small percent of the total salmon and steelhead in the Columbia River basin. As a result, the No Action alternative would not be expected to have a substantial impact on predator populations.

Salmon and steelhead eat aquatic insects, and, as a result, the No Action alternative could increase the total number of aquatic insects in the action area because salmon and steelhead populations would decline. However, aquatic insect populations are very large relative to salmon or steelhead populations. As a result, reducing the number of total salmon and steelhead in the Columbia basin by 25,195,000 would not be expected to impact the health or stability of any insect population.

4.1.3 Effects on the Social and Economic Environment

The No Action alternative could effectively reduce several recreational and commercial salmon and steelhead fisheries in the Columbia River basin and Pacific Ocean. As a result, this alternative could lead to economic loss for local fishermen and communities. These hatchery programs contribute to commercial, Tribal, and sport fisheries in the Columbia River mainstem, its tributairies, and ocean fisheries. For example, the average terminal area harvest (in the years that fishing was allowed) of Carson National Fish Hatchery spring chinook salmon for the period of 1989-1998 for sport and tribal fisheries was 2,615 and 868 fish, respectively (USFWS 2002d). The Little White Salmon National Fish Hatchery produces upriver fall chinook that contribute to commercial and sport fisheries along the west coast of the United States and Canada from Alaska to California. An average of 3,728 Little White Salmon Hatchery fall chinook salmon were harvested annually from 1990-1992 (USFWS 2002c). Of these Little White Salmon fall chinook salmon, commercial fisheries in Alaska, British Columbia, and gillnet fisheries in the Columbia River each harvest greater than 10 percent (Pastor 2002). Eagle Creek National Fish Hatchery produced 2,549 coho salmon (brood year 1996) that were caught in ocean fisheries and 1,316 that were taken in the Columbia River (USFWS 2001f). Fishing provides important economic benefits to local communities from the sale of fishing licenses, boats, tackle, lodging, gasoline, and food. Recreational spending on fishing brought in $854 million in the state of Washington in 2001 (WDFW 2002d). A 1996 survey showed anglers in Oregon spend approximately $80 per fishing day for fishing-related costs (USDI and USDC 1996). Additional revenue accrues to the region from tourism and other non-consumptive uses, some portion of which is dependent upon or encouraged by the presence of salmon and steelhead. Eliminating these hatchery programs would lead to reductions in the number of salmon and steelhead within and outside of the action area and would thus lead to economic and social losses. In addition, under the No Action alternative, many Tribes would likely lose fish that they depend on for commercial, subsistence, and ceremonial purposes.

Reducing these fisheries would be inconsistent with the Policy for Conserving Species Listed or Proposed for Listing Under the Endangered Species Act While Providing and Enhancing Recreational Fisheries Opportunities (61 FR 27978). This policy was jointly issued by the Fish and Wildlife Service and the National Marine Fisheries Service on June 3, 1996 and was issued pursuant to the Presidential Executive order 12962, issued on June 7, 1995. That order requires Federal agencies, to the extent permitted by law, and where practical and in cooperation with States and Tribes, to improve the quality, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunity. Among other actions, the order requires all Federal agencies to aggressively work to promote compatibility and reduce conflict between administration of the ESA and recreational fisheries. In addition, under the No Action alternative, the USFWS would be in violation of current mitigation agreements with WDFW.

4.1.4 Environmental Justice

Under the No Action alternative, fishing opportunities may be lost. Tribal harvest and subsistence fishing opportunities and potential fishing opportunities for low-income persons could be lost, but these populations would not be disproportionately affected by the No Action alternative because other communities would lose the same fishing opportunities.

4.2 Alternative 2 (Proposed Action)

The USFWS would continue its artificial propagation programs under the Proposed Action scenario. As a result, more hatchery fish would be found in the Columbia River basin as compared with the No Action alternative. The environmental impacts related to these assumptions are identified in the following sections and summarized in Table 2.

4.2.1 Effects on the Physical Environment

Water Quality

Under the Proposed Action alternative, there would be a slight decrease in the water quality immediately surrounding the hatcheries in comparison to the No Action alternative because under the Proposed Action alternative treated hatchery effluent would be passed into the rivers. However, because of the relatively small amount of water passing through the facility compared to the total flow of the receiving streams, such effects are expected to be restricted to the immediate area of the outfall and quickly diluted. All effluent must meet Federal and state clean water standards. Under the Proposed Action alternative, more fish carcasses would be added to the ecosystem compared to the No Action alternative, which provide nutrients to aquatic organisms, including listed salmon and steelhead.

Water Quantity

Under the Proposed Action alternative, NMFS would not expect any change in water quantity in most rivers in comparison to the No Action alternative, as the USFWS hatcheries divert water from rivers or springs, circulate it through the hatchery, treat it, and release it back into the river. However, during low water years, a small portion of the Wind River may be dewatered between the Carson National Fish Hatchery's intake and outflow structures. If the Wind River is dewatered, the biological environment would be carefully monitored, and any potential impacts on aquatic species would be minimized through intervention, such as moving the fish.

Riparian Habitat
NMFS would not expect any difference between the effects of the No Action and Proposed Action alternatives on the riparian habitat because no structures would be built or removed in the riparian area under either altarnative. Associated monitoring and evaluation activities associated with the Proposed Action alternative may increase foot traffic in the riparian area, but the impacts of this traffic would be expected to be virtually undetectable.

Fish Passage
Fish passage for wild fish could be slightly delayed under the Proposed Action alternative in comparison to the No Action alternative if weirs associated with the hatcheries disrupt the migration of salmonids. All weirs and ladders associated with hatchery operations would be monitored to prevent mortalities and to minimize delays.

4.2.2 Effects on the Biological Environment

Listed and Non-Listed Salmonids in the Action Area
Interactions between hatchery fish and other fish populations can have a negative effect on both total production from a watershed (through competition with naturally produced fish) and genetic integrity of wild fish (through crossbreeding). Specific hatchery practices, such as fish size at release, time of release, acclimation, and the use of volitional release can all play a role in minimizing these interactions.

NMFS identified five general types of biological effects that artificial propagation programs can have on salmon and steelhead populations. These effects include: (1) abundance, (2) genetics, (3) disease, (4) competition, and (5) predation. A discussion of ecological interactions relative to the artificial propagation programs follows:

(1) Abundance - The use of wild/natural broodstocks can reduce the number of natural spawners. Early broodstock collections in the Columbia River basin may have led to the depletion of wild stocks. Recent broodstock collection activities have been modified to lower the risk of depleting wild donor stocks. In addition, including wild/natural fish in the broodstock is advantageous in increasing the number of adults returning to a subbasin without overwhelming or replacing the natural gene pool. The Touchet River Steelhead and Warm Springs National Fish Hatchery spring chinook programs both incorporate wild/natural fish into their broodstocks.

(2) Genetics - Selective hatchery breeding protocols, the straying of hatchery fish to natural areas, and the use of non-indigenous hatchery stocks tends to deplete the native genetic character of the wild population. However, in the proposed hatchery programs, inadvertent selection would be avoided through implementation of strict mating and fertilization protocols, and by ensuring that hatchery fish are, qualitatively, as similar to naturally produced fish as possible.

A number of hatchery practices can lead to loss of within-population variability. Broodstock selected for particular traits can lead to loss of traits that may have benefit to the wild gene pool. Examples of this include marked shifts in population run timing over several generations when broodstock is selected from one segment of the natural run cycle (Steward and Bjornn 1990). Loss of within-population variability can also occur where a disproportionate ratio of males are mated to females or the mating population is small. Current hatchery practices minimize these types of selection.

Loss of between-population or ESU variability can occur when broodstocks are collected from locations that are remote to the targeted watersheds. For genetic and health reasons, this practice has been largely discontinued. However, three of the USFWS hatchery programs use broodstocks that were derived from stocks outside of the ESU: the Little White Salmon National Fish Hatchery fall chinook salmon, the Carson National Fish Hatchery spring chinook salmon, and the Eagle Creek National Fish Hatchery steelhead. NMFS does not believe that these hatchery programs jeopardize the survival and recovery of the Lower Columbia River chinook salmon ESU, though, because both the Carson spring chinook salmon and the Little White Salmon fall chinook salmon are released in rivers that do not have native populations spring chinook salmon and fall chinook salmon respectively. As a result, these releases would not reduce the natural variability between native stocks because they would not interbreed with native stocks. The Eagle Creek National Fish Hatchery releases steelhead into Eagle Creek on the Clackamas River, where native steelhead are found. However, genetic monitoring has shown that the hatchery and wild/natural populations have maintained genetic separation, and, as a result, genetic introgression of out-of-ESU steelhead is not likely a cause for concern. Crossing of unrelated stocks can also occur with high straying rates of hatchery fish into non-targeted streams (BPA et al. 1994). Hatchery practices have been reformed to minimize straying, and straying of hatchery fish is closely monitored. If straying is problematic, hatchery programs would be adjusted.

(3) Disease - The hatchery environment encourages the spread of pathogens due to relatively high fish densities. However, there is little information on the impacts of infectious diseases on natural production, and no direct evidence of increased incidence or prevalence of disease in wild/natural populations downstream of hatcheries. Although transmission of some pathogens from fish to fish might occur when diseased and healthy fish are held in close proximity, there is little information that suggests similar transmissions in the free-flowing river environment (BPA et al. 1994).

Many of the disease concerns related to hatchery fish are based on old management styles that emphasized the release of large numbers of fish regardless of their health status. Since then, the desire to reduce disease has instigated better husbandry, including critical decreases in fish numbers to reduce the crowding and stress that affects the resistance of salmonids to disease

(Salonius and Iwama 1993; Schreck et al. 1993). Along with decreased densities and improved animal husbandry, advances in fish health care and adherence to federal and interagency fish health policies have considerably decreased the possibility of disease transmission from hatchery fish to wild/native fish.

(4) Competition - Competition for food and space between hatchery and wild juvenile salmonids is greatest at hatchery release sites, where small numbers of wild/natural fish must compete for available resources with large numbers of hatchery fish. Although competition at the release site is expected to diminish as hatchery fish disperse, the initial competition might force wild/natural fish from preferred habitats and increase their susceptibility to predation (BPA et al. 1994).

Salmon and steelhead smolts actively feed during their downstream migration (Becker 1973; Muir and Emmet 1988; Sager and Glova 1988). Competition between hatchery releases and salmonids from outside the action area could occur in the migration corridor if food supplies are inadequate for migrating salmon and steelhead. However, the degree to which smolt performance and survival are affected by insufficient food supplies is unknown (Muir et al. 1994). The available data are more consistent with the alternative hypothesis that hatchery-produced smolts are at a competitive disadvantage relative to naturally produced fish in tributaries and free-flowing mainstem sections (Steward and Bjornn 1990). Proposed artificial propagation programs include monitoring and evaluation activities to further study the interactions between hatchery and wild/natural salmonids in the freshwater environment.

While competition may occur between natural and hatchery juvenile salmonids in, or immediately above, the Columbia River estuary, few studies have been conducted to evaluate the extent of this potential problem (Dawley et al. 1986). The general conclusion is that competition may occur between natural and hatchery salmonid juveniles in the Columbia River estuary, particularly in years when ocean productivity is low. Competition may affect survival and growth of juveniles and thus affect subsequent abundance of returning adults. However, these are postulated effects that have not been quantified or well documented.

Ocean rearing conditions are dynamic. Consequently, fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in nearshore areas affected by upwelling (Chapman and Witty 1993). To date, research has not demonstrated that hatchery and naturally produced salmonids compete directly in the ocean, or that the survival and return rates of naturally produced and hatchery origin fish are inversely related to the number of hatchery origin smolts entering the ocean (Enhancement Planning Team 1986). If competition occurs, it most likely occurs in nearshore areas when (a) upwelling is suppressed due to warm ocean temperatures and/or (b) when the abundance or concentration of smolts entering the ocean is relatively high.

(5) Predation - In general, the extent to which salmon and steelhead smolts of hatchery origin prey on fry from naturally reproducing populations is not known, particularly in the Columbia

River basin. The available information – while limited – is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia River basin (Enhancement Planning Team 1986). However, virtually no information exists regarding the potential for such interactions in the marine environment.

Hatchery releases may contribute to indirect predation effects on listed stocks by attracting predators (birds, fish, pinnipeds) and/or by providing a large forage base to sustain predator populations. On the other hand, a large mass of hatchery fish moving through an area may confuse or distract predators or have a "swamping" effect towards predators providing them prey that are more readily accessible than wild stocks thereby providing a beneficial effect to listed species. In addition, hatchery fish may be substantially more susceptible to predation than naturally produced fish, particularly at the juvenile and smolt stages (Piggins and Mills 1985; Olla et al. 1993).

The Proposed Action alternative would not be expected to substantially impact salmonids in the Columbia River basin. USFWS' hatcheries have been reformed to minimize competition between artificially and naturally produced salmon and steelhead, reduce predation on wild/natural salmonid populations, prevent the transmission of disease from hatchery to natural populations, minimize the genetic introgression of hatchery fish into wild/natural salmonid populations, and prevent the "mining" of natural salmonid populations through broodstock collection practices. However, as compared to the No Action alternative, the Proposed Action alternative would result in increased competition for food and space and an increased risk to the genetic integrity of salmonid populations.

Non-Salmonid Fish Species

The proposed action alternative would increase the number of salmon and steelhead in the Columbia River basin in comparison to the No Action alternative. Most non-salmonid fish found within the action area are potential predators on these salmon and steelhead. However, no fish species feeds solely on salmon and steelhead. One non-salmonid fish species, the sucker, is a potential prey item for salmon and steelhead, but the sucker is not a major component of any salmon or steelhead diet. As a result, the Proposed Action alternative would not be expected to have more than a small impact, if any, on non-salmonid fish populations.

Piscivorous Birds and Other Aquatic and Terrestrial Resources

The Proposed Action alternative would result in more fish prey for piscivorous birds and many other aquatic and terrestrial predators in comparison to the No Action alternative. Salmon and steelhead eat aquatic insects, and, as a result, the Proposed Action alternative could decrease the number of aquatic insects in the action area in comparison to the No Action alternative.

4.2.3 Effects on the Social and Economic Environment

Implementation of the Proposed Action would increase benefits to the human environment in comparison to the No Action alternative. If the HGMPs are approved, and the proposed artificial propagation allowed to occur, additional economic benefits would accrue to residents within the Columbia River region. This alternative would also maintain recreational, commercial, and Tribal fishing opportunities as well as public support of salmon and steelhead recovery efforts compared to the No Action alternative.

Under the Proposed Action alternative, additional fish would be available for harvest, as specified in subsection 4.1.3, Effects on the Social and Economic Environment, of this Environmental Assessment.

4.2.4 Environmental Justice

Executive Order 12898 (59 FR 7629) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. As under the No Action alternative, the Proposed Action alternative would not be expected to affect human health of any populaiton located in the action area.

Under the Proposed Action alternative, increased fishing opportunities may result as compared to the No Action alternative. These fishing opportunities would be available to all population segments. Tribal harvest and subsistence fishing opportunities, and potential opportunities for low-income persons could increase, but these communities would not be disproportionately affected compared to other communities.

4.3 Cumulative Impacts

Cumulative impacts from NMFS' current proposed action under 4(d) rule Limit 5 would be minor. Incremental impacts on the environment are included in the discussion above. NMFS' 4(d) Rule is only one element of a large suite of regulations and environmental factors that may influence the overall management of artificial propagation programs. For example, water quality is monitored and measured through permits from the Department of Ecology. Programs that meet the requirements of the 4(d) Rule Limit 5 would include monitoring and adaptive management measures so that managers can respond to changes in the status of affected listed salmon steelhead. Monitoring and adaptive management would help ensure that the affected ESUs are adequately protected and help counter-balance any negative cumulative impacts.

Other Federal, state, and tribal actions are expected to occur within the action area that would increase fish populations in the Columbia River basin. Federal actions for salmon recovery in the Columbia River basin that are currently underway include initiatives by the Northwest Power

Planning Council. State Initiatives include recently passed legislative measures to facilitate the recovery of listed species and their habitats, as well as the overall health of watersheds and ecosystems. Regional programs are being developed that designate priority watersheds and facilitate the development of the watershed management plans. Tribes have developed a joint restoration plan for anadromous fish in the Columbia River basin, known as the Wy-Kan-Ush-Mi Wa-Kish-Wit or Spirit of the Salmon plan. These planning efforts, in conjunction with the Proposed Action, are expected to help increase salmon and steelhead populations in the action area because of compatible goals and objectives.

5.0 Agencies Consulted

The following agencies and entities were consulted during the development of this environmental assessment.

National Marine Fisheries Service
U.S. Fish and Wildlife Service
Washington Department of Fish and Wildlife

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